

Station News

The Connecticut Agricultural Experiment Station
Volume 12 Issue 11 | November 2022



The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to "Putting Science to Work for Society," a motto as relevant today as it was at our founding in 1875.



CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

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DR. JASON C. WHITE participated in a Zoom call with Dr. Denise Mitrano of ETH Zurich to discuss plastics use in agriculture (October 4); along with **DR. NUBIA ZUVERZA-MENA** and **DR. TRUNG BUI** participated in a Zoom call with officials of CT DEEP and the town of Canton to discuss a PFAS-contaminated site (October 4); met by Zoom with Crop Life America to discuss mutual interests (October 4); along with **DR. YI WANG** met by Zoom with Prof. Korin Wheeler of Santa Clara University to discuss collaborative research (October 4, 20); along with **DR. SARA NASON**, **DR. NUBIA ZUVERZA-MENA** and **DR. SARA THOMAS** participated in a Zoom call with collaborators at Yale University and the University of Minnesota to discuss progress on a joint NIEHS grant (October 5); participated in the weekly Center for Sustainable Nanotechnology (CSN) All Hands Zoom call (October 5, 19, 26); participated in a Zoom call with collaborators at the University of California San Diego, University of California Riverside, and Carnegie Mellon University to discuss a joint manuscript (October 6, 13); participated in a Zoom meeting with DAS Construction Services to discuss the CAES Greenhouse project (October 7); along with **DR. SHITAL VAIDYA**, **DR. CHRISTIAN DIMKPA** and **DR. WADE ELMER** hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA research project (October 11, 18); hosted the monthly CSN Nanochem-Plant call on Zoom (October 11); along with **MR. MICHAEL LAST** and **DR. LINDSAY TRIPLET** hosted the CAES quarterly Board of Control meeting (October 12); along with **DR. YI WANG** and **DR. WADE ELMER** hosted a Zoom call with collaborators at the University of Massachusetts to discuss progress on a USDA nanosulfur grant (October 14); participated in the CSN Plant-Biosurfaces monthly call (October 17); hosted Dr. Sofie Thijs of Hasselt University in Belgium and discussed collaborative research on PFAS remediation (October 17-18); was interviewed by Mr. Brian Scott-Smith of WSHU regarding the first New England Cannabis Research and Education Conference, Eastern Connecticut State University, October 21-22 (October 18); participated in an Organizing Committee Zoom call for the 2023 International Phytotechnologies Conference (October 20); participated in a Zoom meeting with collaborators from Ca' Foscari University of Venice, Italy to discuss a joint research program (October 21); along with **DR. CHRISTIAN DIMKPA**, met by Zoom with colleagues in Mauritania to discuss collaborative research (October 21); attended the first New England Cannabis Research and Education Conference, Eastern Connecticut State University, October 21-22 and gave a presentation titled “The Connecticut Agricultural Experiment Station: 147 Years of Consumer Product Safety Testing Applied to Hemp and Adult Use Cannabis” (October 22); attended the Materials Innovation for Sustainable Agriculture (MISA) conference at the University of Central Florida and gave a presentation titled “Nanotechnology-enabled agriculture: A path to global food security?” (October 23-25); gave two lectures by Zoom to a graduate class at the University of Massachusetts Amherst titled Nanotechnology-enabled agriculture: A path to global food security?” and “PFAS remediation in contaminated soils” (October 27); attended the Regional Symposium on Climate Change, Planetary, and Human Health: Challenges and Opportunities and gave a presentation titled “Nanotechnology and climate smart agriculture: A path to global food security?” (October 28); and attended the 21st World Congress of Food, Science and Technology; Future of Food: Innovation, Sustainability and Health in Singapore and gave a presentation titled Nanotechnology-enabled agriculture: A path to global food security? (October 31-November 3).



Dr. Jason White giving a lecture at the Regional Symposium on Climate Change, Planetary, and Human Health at Rutgers University, October 28, 2022.

PUBLICATIONS

1. Cao, Y., Ma, C., Yu, H., Tan, Q., Mo, A., **White, J. C.**, and Xing, B. (2022). The role of sulfur nutrition in plant response to metal(loid) stress: Facilitating biofortification and phytoremediation. *J. Haz. Mater. In press.*

Abstract: Metal(loid)s contamination poses a serious threat to ecosystem biosafety and human health. Phytoremediation is a cost-effective and eco-friendly technology with good public acceptance, although the process does require a significant amount of time for success. To enhance the phytoremediation efficiency, numerous approaches have been explored, including soil amendments application to facilitate remediation. Sulfur (S), a macro-nutrient for plant growth, plays a vital role in several metabolic pathways that can actively affect metal(loid) phytoextraction, as well as attenuate metal(loid) toxicity. In this review, different forms of S-amendments (fertilizers) on metal(loid) uptake and translocation in plants upon exposure to various metal(loid) types are evaluated. Possible mechanisms for S application alleviating metal(loid) toxicity are documented at the physiological, biochemical and molecular levels. Furthermore, this review highlights the crosstalk between S-assimilation and other biomolecules, such as phytohormones, polyamines and nitric oxide, which are also important for metal(loid) stress tolerance. Given the effectiveness and potential of S amendments on phytoremediation, future studies should focus on optimizing phytoremediation efficiency in long-term field studies and on investigating the appropriate S dose to maximize the food safety and ecosystem health.

2. Wang, Y., Deng, C., Shen, Y., Borgatta, J., Dimkpa, C. O., Xing, B., Parkash Dhankher, O., Wang, Z., White, J. C., and Elmer, W. E. (2022). Surface coated sulfur nanoparticles suppress Fusarium disease in field grown tomato: Increased yield and nutrient biofortification. *J. Agric. Food Chem. In press.*

Abstract: Little is known about the effect of nano sulfur (NS) under field conditions as a multi-functional agricultural amendment. Pristine and surface coated NS (CS) were amended in soil at 200 mg/kg that was planted with tomato (*Solanum lycopersicum*) and infested with *Fusarium oxysporum* f. sp. *lycopersici*. Foliar exposure of CS (200 µg/ml) was also included. In healthy plants, CS increased tomato marketable yield up to 3.3~3.4-fold compared to controls. In infested treatments, CS significantly reduced disease severity compared to the other treatments. Foliar and soil treatment with CS increased yield by 107 and 192% over diseased controls, respectively, and significantly increased fruit Ca, Cu, Fe, and Mg contents. A \$33/acre investment in CS led to an increase in marketable yield from 4,920 to 11,980 kg/acre for healthy plants and from 1,135 to 2,180 kg/acre for infested plants, demonstrating the significant potential of this nano-enabled strategy to increase food production.

3. Sakhno, Y., Ma, C., White, J. C., and Jaisi, D. (2022). Role of cation substitution and synthesis condition in calcium phosphate based novel nanofertilizer on lettuce (*Lactuca sativa*) yield. *ACS Sust. Chem. Eng. In press.*

Abstract: Hydroxyapatite nanoparticles (HANPs) have received increasing attention as a potential novel fertilizer. Although stoichiometric HANPs have limited solubility, they can be tuned for more controlled P-release applications. With the aim to enhance the dissolution for maximizing the P delivery to plants, we synthesized HANPs and dicalcium phosphate anhydride (DCPA) under varying crystallization conditions (temperature, pH, and cation substitution). The efficacy of these materials on improving lettuce (*Lactuca sativa*) yield was investigated in greenhouse studies. Comparative analyses of shoot and root biomass, tissue nutrient content, and P loss in the leachate (used as a surrogate for runoff) show that all HANPs and DCPA stimulated lettuce growth, but the extent of enhancement was a function of synthesis condition. Lettuce fertilized with DCPA, a more soluble Ca-P product, showed two times higher crop yield than controls but P loss in leachate was the highest. On the other hand, lettuce fertilized with HANPs synthesized at pH 7.0 resulted in a 73% greater crop yield than the control and the least P leachate among all Ca-P products tested. Considering the 'green' efficiency that accounts for both promoting plant growth and limiting P loss, HANP synthesized at pH 7.0 is more optimal. These results demonstrate that tuning the properties of HANPs is an ideal approach to optimize the effectiveness of nanofertilizer to enhance crop growth and yield and minimize P loss. It further means that developing tunable precision nanofertilizers specific to a crop or soil condition can be one of the effective and sustainable approaches toward meeting global food demands while simultaneously minimizing the negative environmental impacts of agriculture

4. Adeel, M., Ahmad, M. A., White, J. C., Kah, M., and Fraceto, L. (2022). Nano-enabled approaches for sustainable development of food and agricultural system. *NanoImpact. In press.*

Abstract: An increasing population demands significant increases in food production to address global food insecurity. However, a changing climate, the lack of sustainability of conventional agricultural practices, and a continuing loss of arable soil will confound these efforts. It is clear that sustainable solutions for agricultural production, protection, distribution, and storage will require innovative strategies and integration of knowledge from diverse fields. One strategy is to enhance the intrinsic capabilities of agricultural products, particularly for crops grown under stressed or marginal conditions; this approach will reduce agricultural inputs, minimize the negative consequences of agrochemical application, and address growing food demand. When agricultural plants are under stress, the over-accumulation of reactive oxygen species leads to the damage of important biomolecules such as nucleic acids and proteins, resulting in growth inhibition. Therefore, strategies that modulate ROS homeostasis with nanobiotechnology have great potential to develop plants with an enhanced tolerance to stress. However, the safety of any and all nano-enabled approaches is critical to success, and as such, environmental health and safety (EHS) must be foundational to this work.

5. Kandhol, N., Singh, V. P., Mochida, K., **White, J. C.**, Tran, L.-S. P., and Tripathi, D. K. (2022). Plant growth hormones and nanomaterial interface: Linking development to defense. *Plant Cell Phys.* DOI: [10.1093/pcp/pcac147](https://doi.org/10.1093/pcp/pcac147)

Abstract: The global increase in nanotechnology applications has been unprecedented and has now moved into the area of agriculture and food production. Applications with promising potential in sustainable agriculture include nanobiosensors, nanofertilizers, nanopesticides, nano-mediated remediation strategies for contaminated soils and nanoscale strategies to increase crop production and protection. Given this, the impact of nanomaterials/nanoparticles (NPs) on plant species needs to be thoroughly evaluated as this represents a critical interface between the biosphere and environment. Importantly, phytohormones represent a critical class of biomolecules to plant health and productivity; however, the impact of NPs on these molecules is poorly understood. In addition, phytohormones, and associated pathways, are widely explored in agriculture to influence several biological processes for improvement of plant growth and productivity under natural as well as stressed conditions. However, the impact of exogenous applications of phytohormones on NP-treated plants have not been explored. The importance of hormone signaling and crosstalk with other metabolic systems makes these biomolecules ideal candidates for a thorough assessment of NP impacts on plant species. This article presents a critical evaluation of the existing yet limited literature available on NP-phytohormone interaction in plants. In addition, the developing strategy of nano-enabled precision delivery of phytohormones via nanocarriers will be explored. Last, directions for future research and critical knowledge gaps will be identified for this important aspect of nano-enabled agriculture.

DEPARTMENTAL RESEARCH UPDATES

DR. CHRIS DIMKPA attended a conference organized by FERARI (Fertilizer Research and Responsible Implementation) in Accra and Tamale, Ghana (October 23-29). FERARI is a 5-year project executed by the International Fertilizer Development Center Muscle Shoals, Alabama and funded by the Mohammed the 6th Polytechnic University and OCP, Morocco. **DR. DIMKPA** was an inaugural partner in the FERARI project in 2019. The objectives of the conference were to assess FERARI's research and implementation activities; reflect on the experimental and survey findings over the past 3 years, and with that identify options for improvement and follow up activities; and interact with actors and discuss the role of the FERARI approach in short term actions and long term strategic institutional development for a resilient food and fertilizer system in Ghana. **DR. DIMKPA** gave a presentation on "Approaches for Increasing Phosphorus Use Efficiency: The Case for Chitosan and Tripolyphosphate." Participants in the conference were drawn from several countries including the host country, Morocco, Netherlands, Belgium, India, and the United States. The group visited small-holder farms in Northern Ghana to assess the impact of responsible fertilization on crop yield and farmer livelihoods.



DR. TARIQ SOFI attended the 84th Annual Northeast Tree Fruit IPM Workshop where he delivered a Talk on "Diagnosis and management of Foliar and Canker diseases of Apple in Kashmir" (October 25-26).



Dr. Tariq Sofi speaking at the 84th Annual Northeast Tree Fruit Integrated Pest Management Workshop, October 25-26, 2022.

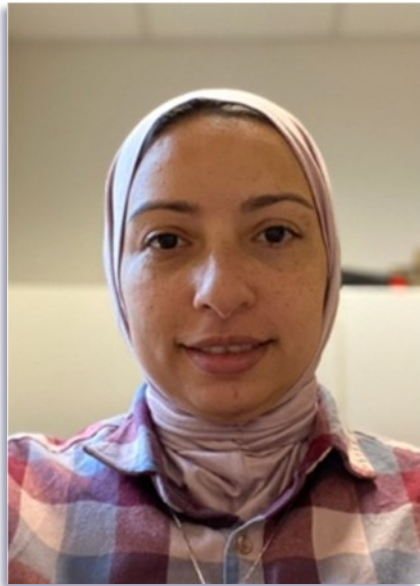
DR. NUBIA ZUVERZA-MENA, along with **DRS. TRUNG HUU BUI, JASON WHITE** and **CHRISTIAN DIMKPA** had a virtual meeting with an administrator from the town of Canton, CT, staff from the CT Department of Energy and Environmental Protection (DEEP), and staff from GZA GeoEnvironmental (October 4). The meeting was to discuss potential sites for collecting soil samples for a research project on PFAS; an emerging toxic contaminant of worldwide concern. **DR. BUI** collected soil samples from Canton on October 26.



Dr. Trung Huu Bui collecting soil samples in Canton, CT on October 26, 2022.

DR. ZUVERZA-MENA and **DR. SARA NASON** presented the hybrid talk “Contaminants Uptake in Fiddleheads - Pilot Study with Tribes” at the EPA Tribal Environmental Conference in Bar Harbor, ME (October 20).

NEW STUDENTS, STAFF, AND VOLUNTEERS



DR. RANIA ELTANBOULY joined The CAES's Department of Analytical Chemistry as a research affiliate in October 2022. Rania received her PhD in plant science from UCONN in 2018. Since then, Rania has been working as an Assistant professor in Floriculture, Ornamental Horticulture and Landscape Gardening Department in the College of Agriculture, Alexandria University, Egypt. Rania also worked as a Principal Investigator on a project using CRISPR/Cas9 technology. Rania's research skills include mutation breeding and molecular biology of turf grass, plant *in vivo* and *in vitro* culturing, PCR-based techniques, DNA and RNA extractions, plant genetic engineering including agrobacterium transformation, plant hormone extraction and bioinformatic analysis. At The CAES, Rania will collaborate with **Drs. Jason White,**

Christian Dimkpa and **Washington Luis da Silva** to assess the use of nanoparticles along with CRISPR-Cas genetic engineering to increase secondary metabolites in medicinal plants, including under abiotic stress conditions. Rania's work is important considering that various methods have previously been tested for increasing medicinal plants' active ingredients but with low outcome. Combining genetic engineering and nanotechnology could open the door for optimizing the use of medicinal plants and could allow for extracting active ingredients from callus directly, instead of waiting until plants reach their full life cycle. This will decrease the cost while increasing efficiency.

DR. TARIQ AHMAD SOFI joined The CAES's Department of Analytical Chemistry as a visiting researcher in October 2022. He is an Assistant Professor/Junior Scientist at the Division of Plant Pathology, (FoH) SKUAST-Kashmir, Shalimar Srinagar, Jammu & Kashmir in India. He will synthesize, characterization, and evaluate nanoscale nutrients, specifically magnesium, against *Venturia inaequalis* and *Erwinia amylovora*. Tariq will be working with **Drs. White, Dimkpa, Keriö,** and **Zeng**. Tariq's research will be helpful in deciphering the importance of nanotechnology in agriculture and particularly in Tree fruit disease and health management strategies. It is expected to contribute to reducing the dose chemicals applied as pesticides, and with better efficacy. Thus, it can possibly help in reducing the negative impact of pesticides in the environment. Ultimately, knowledge from such research helps in aligning the use of nanoscale materials as a components of Integrated Disease/Pest Management programs.





DR. PEIYANG WANG started her postdoctoral research at the Department of Analytical Chemistry, CAES in October 2022. Dr. Wang obtained her bachelor's degree in food science from the University of Manitoba, Canada. She then commenced her master's and doctoral studies in the Faculty of Agriculture and Environmental Sciences at McGill University, Canada. Her doctoral research focused on the fate and effects of nanopesticides in strawberry plants and fruits. She developed an analytical strategy to investigate pesticides in nanoencapsulated (NEP) formulations in strawberry plants and to compare the fate from field to fork and

potential effects on the plant (phenology parameters and phenolic compounds) between conventional and NEPs. This research provided new tools for the assessment of NEPs and contributes to a better assessment of the risk associated with nanotechnology. In addition, Peiyang worked as a research assistant in the food chemistry lab (McGill) to build a model to identify the different types of plastic materials using pyrolysis-GC/MS. At The CAES, Peiyang will conduct research on the analysis of contaminants (pharmaceuticals, personal care products, pesticides, estrogens, heavy metals and others) in reclaimed wastewater. Additional investigations will focus on the effect of reclaimed wastewater irrigation on zucchini plants. Currently, she is participating in a project funded by the USDA titled "Assessing the suitability of recycled wastewater with variable stormwater influence for use in crop irrigation." Stormwater influence causes high variability in the quality and quantity of both wastewater and treated wastewater effluent, affecting the suitability of reclaimed water for potable and non-potable applications. To successfully implement water reuse in the US, she will assess the influence of stormwater on the suitability of wastewater effluent for agricultural irrigation.

GRANTS AWARDED

1. DR. MEGAN LINSKE (Co-PI) was awarded a subcontract for BanfieldBio's National Institutes of Health, Direct Phase II Small Business Innovation Research Award (1R44AI172565-01) titled "Polymeric Matrix Loaded with Tick Repellent or Toxic Compositions for Incorporation into Fabrics or Granular Dispersal." 9/23/2022 – 9/22/2025. \$333,028.

DEPARTMENTAL RESEARCH UPDATES

DR. GOUDARZ MOLAEI and **DR. DOUGLAS BRACKNEY** met with Dr. Linda Niccoli, James Meek, and Sara Niesobecki of the Yale Department of Epidemiology of Microbial Diseases to discuss a joint research project on Powassan virus within the framework of the CAES Passive Tick and Tick-borne Pathogen Surveillance Program (October 3).

DR. GOUDARZ MOLAEI, **DR. PHILIP ARMSTRONG**, and **DR. ANDREA GLORIA-SORIA** attended annual virtual meeting of Multistate NE1943: Biology, Ecology and Management of Emerging Disease Vectors (October 20).

DR. VICTORIA LYNN SMITH was interviewed **MS. ANGELA BRANSFIELD** participated via Zoom in Yale's Biosafety Committee meeting (October 20); chaired a CAES DEI Committee Meeting (October 25); and participated in the Federal Select Agent Program's Responsible Official webinar Entity Inspector Entry Requirements (October 26).

MS. JAMIE CANTONI and **DR. MEGAN LINSKE** participated in an exploratory virtual call with Dartmouth College to discuss climate-related impacts on tick populations throughout the Northeast (October 3); and attended the Tick-borne Disease Working Group virtual meeting (October 4).

DR. ANDREA GLORIA-SORIA presented an overview of her research at the Multistate NE1943 Annual Meeting held virtually (October 20).

MS. NOELLE KHALIL participated in Quinnipiac University's Annual Career Fair, set up a booth, and discussed internship, volunteer/collaborator, and seasonal employment opportunities at the CAES with the fair attendants (October 17).

DR. MEGAN LINSKE participated in a Zoom call with Professor Jonathan Winter, Ph.D., and graduate student Lucas Price (Dartmouth College) to discuss a collaborative project investigating climate related impacts on tick populations throughout the Northeast (October 3); participated in the Wildlife Society's (TWS) Leadership Institute (LI) Class of 2022 mentoring program meeting (October 6); hosted entomologist candidate Dr. Hany Dweck (October 17); participated in TWS Diversity, Equity, and Inclusivity (DEI) meeting (October 17); attended the first meeting of the BanfieldBio, Inc.'s National Institutes of Health (NIH), Direct Phase II Small Business Innovation Research (SBIR) Award Team at North Carolina State University in Raleigh, NC (October 23-26); participated in the Northeast Regional Center of Excellence in Vector-borne Diseases (NEVBD) leadership call

(October 24); and hosted Christin Arnini (New Haven Science Fair Committee) for planning discussions and collaborative work on the new Girl's STEM Program (October 28).

DR. GALE E. RIDGE presented a talk via Zoom on jumping worms to the Cheshire Garden Club and advised their board on management of the worm (October 12); presented two short talks about jumping worms via Zoom to students at Weston High School (October 13); and was interviewed about the Western conifer seed bug and brown marmorated stink bug by Hurst News (October 19).

DR. CLAIRE RUTLEDGE taught the lecture and laboratory portion of the class "Insects that Attack Trees" for the Connecticut Tree Protective Association's Arboriculture 101 course (October 6-7).

MR. JOHN SHEPARD provided updates from the CT Mosquito Trapping and Arbovirus Surveillance Program as part of Arbovirus Situational Awareness conference calls organized by the Northeast Regional Center for Excellence in Vector-Borne Diseases (October 3, 11), and participated via Zoom in a Board of Directors meeting of the Northeastern Mosquito Control Association (October 24).

MS. TRACY ZARRILLO presented an invited talk titled "Wild Bee Research in Connecticut" at the "Bees of Rhode Island Research Symposium" (October 5); attended a Zoom meeting hosted by Spencer Hardy of the Vermont Center for Ecological Studies to discuss collaboration on a regional wild bee diversity project for the northeast US (October 6); and hosted a lab visit from David Rubin, an undergraduate student from Yale University, to provide taxonomic guidance on his wild bee research project (October 27).

DR. KIRBY C. STAFFORD III (Emeritus Scientist) participated as a member in a meeting of the Tick-Borne Disease Working Group (October 4-5); presented a talk on ticks and tick-borne diseases to the Wallingford Garden Club (October 11); and participated as a member in a meeting of the Tick-Borne Disease Working Group (October 24-25).

DR. KIMBERLY STONER (Emeritus Scientist) led a "Pollinator Walk" in City Meadow in the center of Norfolk, CT, as part of the Haymarket Book Festival, followed by a discussion on management of stormwater and invasive plants and encouragement of native plants for pollinators (October 2).

PUBLICATIONS

- McMillan, J. R., Olson, M. M., Petruff, T., Shepard, J. J., and Armstrong, P. M.** (2022). Impacts of *Lysinibacillus sphaericus* on mosquito larval community composition and larval competition between *Culex pipiens* and *Aedes albopictus*. *Sci Rep.* 12(1), 18013.

Abstract: Effectiveness of mosquito larvicide active ingredients (AI), such as *Lysinibacillus sphaericus*, varies between species, yet little is known regarding how differential effectiveness manifests in larval communities in applied settings. To examine how differential effectiveness of *L. sphaericus* influences larval community dynamics, we performed two experiments. We performed a field experiment in which containers were seeded with a standardized nutrient treatment, mosquitoes colonized the containers, and then containers received

one of three *L. sphaericus* applications. We then performed competition assays between *Culex pipiens* and *Aedes albopictus* in low nutrient environments using multiple interspecific ratios and the presence/absence of a low dose of *L. sphaericus*. Field results demonstrated elimination of *Culex* spp. from treated containers while container breeding *Aedes* spp. proliferated across all treatments. *Lysinibacillus sphaericus* did not influence competition between *Cx. pipiens* and *Ae. albopictus*, and the *L. sphaericus* application eliminated *Cx. pipiens* in all treatment replicates while survival of *Ae. albopictus* was similar between treated and untreated containers across interspecific ratios. *Lysinibacillus sphaericus* is an effective AI for control of *Culex* spp. However, different AIs should be utilized in habitats containing non-*Culex* genera while a mix of AIs should be utilized where coexistence of multiple genera is expected or confirmed.

2. **Gloria-Soria, A.** (2022). Special Collection: Highlights of Medical, Urban and Veterinary Entomology. Highlights in Medical Entomology. *Journal of Medical Entomology*, 59(6), 1853–1860. DOI: [10.1093/jme/tjac063](https://doi.org/10.1093/jme/tjac063)

Abstract: Life remained far from normal as we completed the first year of the Covid-19 pandemic and entered a second year. Despite the challenges faced worldwide, together we continue to move the field of Medical Entomology forward. Here, I reflect on parallels between control of Covid-19 and vector-borne disease control, discuss the advantages and caveats of using new genotyping technologies for the study of invasive species, and proceed to highlight papers that were published between 2020 and 2021 with a focus on those related to mosquito surveillance and population genetics of mosquito vectors.

ENVIRONMENTAL SCIENCE AND FORESTRY

GRANTS AWARDED

1. **DR. SCOTT C. WILLIAMS** (PI-CAES) was awarded a subcontract for Banfield-Bio’s National Institutes of Health, Direct Phase II Small Business Innovation Research Award (1R44AI172565-01) titled “Polymeric Matrix Loaded with Tick Repellent or Toxic Compositions for Incorporation into Fabrics or Granular Dispersal.” 9/23/2022 – 9/22/2025. \$333,028.

DEPARTMENTAL RESEARCH UPDATES

DR. SCOTT WILLIAMS participated in a Zoom call with Dartmouth Professor Dr. Jonathan Winter and graduate student Lucas Price about collaborative tick data investigating climate related impacts throughout the Northeast (October 3); participated in a Zoom call with collaborators from Columbia University and Maine Medical Center Research Institute about the need for IRB approval for ongoing research project (October 3); met with agricultural entomologist candidate Dr. Jeremy Anderson (October 7); met with agricultural entomologist candidate Dr. Laura Russo (October 14); met with agricultural entomologist candidate Dr. Haney Dweck (October 17); met with agricultural entomologist candidate Dr. Kelsey Fisher (October 18); participated in a Zoom call with Drs. Maria Diuk-Wasser and Daniel Ruiz-Carrascal of Columbia University about modeling efforts on past integrated tick man-

agement interventions (October 19); gave an invited lecture on diversity and clandestine wildlife species of Guilford, CT to the group Women Recreating Retirement (27 attendees) (October 19); participated in a Zoom call to determine new CAES forester position interviewees (October 21); attended the kickoff meeting of the BanfieldBio's National Institutes of Health, Direct Phase II Small Business Innovation Research Award Team at North Carolina State University in Raleigh, NC (October 23-26).

MR. JOSEPH P. BARSKY organized and coordinated the Standard First Aid/Adult CPR/AED training session at CAES (24 CAES employees attended) (October 4).

MR. GREGORY BUGBEE participated in a United States Geological Survey virtual meeting on creating a national database of aquatic invasive species, where they are located, and the environments where there are favored (October 13); spoke at a virtual meeting of the West Lake Association (Guilford) on CAES IAPP 2022 Aquatic Plant Survey Results. (approx. 10 attendees) (October 21); with **MS. SUMMER STEBBINS** gave an update on hydrilla in the Connecticut River to the Connecticut River Hydrilla Workgroup (approx. 25 attendees) (October 25); with **MS. SUMMER STEBBINS** gave a talk titled "Pachaug Pond Aquatic Plant Update 2022" to the Pachaug Pond Weed Control Authority at the Griswold Town Hall (approx. 20 attendees) (October 26); gave a workshop titled "Invasive Aquatic Plants in Connecticut's Lakes, Ponds, and Rivers" at the Connecticut Association of Conservation and Inland Wetland Commissions Conference in North Haven (approx. 50 attendees) (October 29).

DR. SUSANNA KERIÖ served on the CT Tree Protection Examining Committee (October 3); attended as CAES representative in the McIntire-Stennis Grant Renewal virtual meeting (October 14); served in a meeting of the CT Urban Forest Council's conference organizing committee (October 17); served in a meeting of the Yale University Biosafety Committee (October 20); served in a meeting of the CT Urban Forest Council's conference organizing committee (October 24); participated in organizing the CT Forest Forum 2022 Conference in Plantsville, CT (October 26).

DR. SARA NASON met with colleagues from the CT Department of Public Health and the University of Connecticut to discuss ongoing PFAS analysis efforts in the state (October 7); attended meetings for the Benchmarking and Publications for Non-Targeted Analysis working group (October 13, 18, 19, 27); gave a presentation titled "Contamination Uptake in Fiddleheads – Pilot Study with Tribes" at the Fall 2022 EPA Tribal Environmental Conference, Bar Harbor, ME (October 19).

DR. ITAMAR SHABTAI attended a video meeting with collaborators from Cornell University to discuss an ongoing study looking at the interactions between root exudates and soil minerals (October 12); he met with the Spherical Grating Monochromator (SGM) beamline scientist at the Canadian Light Source to discuss data analysis of synchrotron-radiation x-ray absorption spectroscopy (October 28).

DR. BLAIRE STEVEN traveled to the University of the Arctic in Tromso, Norway, to participate in a Ph.D. defense in the Faculty of Biosciences, Fisheries and Economics, gave invited lecture titled "Biological Soil Crusts as a Model for Terrestrial Carbon Cycling," (25

students and 10 faculty attendees), and held meetings to discuss collaborative potential between research at CAES and the Arctic University (October 10-13).

DR. JEFFREY WARD participated in Forest Ecosystem Monitoring Cooperative (FEMC) Steering Committee Meeting (October 4); spoke on assessing post-defoliation tree health and management recommendations at "Oak defoliation wood tour" in Sharon (11 attendees) (October 9); participated in Forest Ecosystem Monitoring Cooperative (FEMC) State Coordinators virtual meeting (October 13); participated in a Connecticut Forest and Park Association Governance Committee meeting (October 17); interviewed by Willard Wood (Lakeville Journal) about the impact of spongy moth defoliation on tree health (October 20); spoke on "A short history of the Connecticut Forest" for the Orchard Valley Garden Club in Southington (33 attendees) (October 25).

DR. LEIGH WHITTINGHILL attended the Farmland Access and ownership for urban farmers listening tour organized by UConn extension and Keney Park Sustainability Project in the Hartford area (October 13); Attended the GC3 Climate Smart Agriculture and Forestry Working Group (October 28); Participated in a podcast interview for "Growing Greener," with Thomas Christopher and Felix Carroll, editor of "Cuttings" the newsletter of the Berkshire Botanical Garden (October 31).

PUBLICATIONS

1. **Whittinghill, L.** (2022). How to Construct a Plastic Wading Pool Garden. CAES Fact Sheet.
2. Brueck, C. L., **Nason, S. L.**, Multra, M. G., and Prasse, C. (2022). Assessing the Fate of Antibiotics and Agrochemicals During Anaerobic Digestion of Animal Manure. *Science of the Total Environment*. DOI: [10.1016/j.scitotenv.2022.159156](https://doi.org/10.1016/j.scitotenv.2022.159156)

Abstract: Antibiotics and pesticides are used extensively by the livestock industry. Agricultural chemicals can pose potential human and environmental health risks due to their toxicity and through their contributions to antimicrobial resistance, and strategies to reduce their emission into the environment are urgently needed. Anaerobic digestion (AD) is a sustainable technology for manure management that produces biogas while also providing an opportunity to degrade agricultural chemicals that are present in manure. While the effects of selected chemicals on biogas production have been investigated previously, little is known about chemical transformations during AD. Using lab-scale AD batch reactors containing dairy manure, degradation kinetics and transformation products (TPs) were investigated for twenty compounds that are likely to be present in manure management systems and that we hypothesized would transform during AD. Digestate samples were extracted using a modified quick, easy, cheap, effective, rugged, and safe (QuEChERS) method and analyzed using liquid chromatography – high-resolution mass spectrometry. Eleven of the tested chemicals degraded, leading to the formation of 47 TPs. Three compounds degraded abiotically only, two degraded biotically only, and six degraded both abiotically and biotically. These results suggest that in addition to renewable energy generation, AD contributes to the degradation of chemical contaminants present in agricultural waste streams. However, the potential toxic effects of TPs require further investigation.

DR. NEIL SCHULTES, gave an oral presentation entitled “Probing metabolite requirements for *Erwinia amylovora* disease establishment” at the 84th Annual Meeting of New England Tree Fruit IPM Working Group, Fairlee, VT (October 25-26) (50 attendees).

DR. YONGHAO LI participated in the National Plant Diagnostic Network Online Communication & Web Portal Committee meeting via Zoom (6 adults) (October 12); gave a lecture “Diseases of Trees” for the Connecticut Tree Protective Association Arboriculture 101 Courses in New Haven (35 adults) (October 13); presented “Principles of Organic Gardening” to the East Hartford Garden Club members in East Hartford (23 adults) (October 24); instructed “Tree Diseases” in the Hand-on Night for the Connecticut Tree Protective Association Arboriculture 101 Courses in New Haven (30 adults) (October 27); participated in the National Plant Diagnostic Network Northeast Regional Meeting via Zoom (14 adults) (October 28).

DR. ROBERT MARRA gave a presentation on beech leaf disease at the annual meeting of the Connecticut Urban Forest Council (50 adults) (October 26).

DR. QUAN ZENG met Agricultural Entomologist candidate 1 (October 7), candidate 3 (October 17), and candidate 4 (October 18), attended the graduate committee progress meeting of Jared Zaporski from Michigan State University through Zoom (October 20), attended the 84th Annual Northeastern Tree Fruit IPM Meeting in Fairlee, VT and presented two talks “Mechanism of Blossom Protect in Controlling Fire Blight Infection” and “Fire blight pathogen *Erwinia amylovora* enters apple leaves through abscission points of leaf structures” (October 24-26) (65 attendees); attended a virtual editorial meeting for Microbiology Spectrum (October 26).

EVENTS

The Plant Pathology Department came in first place in the 2nd Annual Pumpkin Carving Contest. They won with 50% of the 14 votes that were cast. The election results were not contested. Thanks to **DR. VAIDYA** for organizing the contest and closely monitoring the election process. The winning 2022 pumpkin is pictured below.



DR. JATINDER S AULAKH had Zoom meeting with Dr. Wang Huanzhong, Associate professor at UCONN, on a grant collaboration (October 26); and attended the Connecticut Invasive Plant Council virtual meeting (October 19) (8 attendees); and attended the North-eastern Invasive Plant Council virtual meeting (October 20) (23 attendees); had Zoom meeting with Dr. Vipin Kumar, Assistant professor at KSU, on a collaborative research project to determine the molecular and physiological mechanisms of herbicide resistance in Palmer amaranth biotype from Connecticut (October 16).

DR. CAROLE CHEAH gave a presentation on collaborations in biological control of hemlock woolly adelgid at the 45th Annual Meeting and Environmental Conference of the Connecticut Association of Conservation and Inland Wetlands Commissions, Inc. (CACIWC) in North Haven on (October 29) (20 attendees).

DR. RICHARD COWLES presented “New invasive tree pests” for the Hartford Tree Commission via Zoom (October 5) (20 participants). He discussed “A synthesis of the ‘wolf in sheep’s clothing’ phenomenon” for the Biology Department seminar at ECSU, Willimantic (October 14) (30 participants), and again for the Connecticut Entomological Society via Zoom (October 21) (20 participants); presented “Management options for beech leaf disease,” at the Connecticut Urban Forest Council’s 2022 Annual Forest Forum, Milldale, CT, (October 26) (25 participants); and discussed “Exotic pests and their impact on agriculture,” to two Cornell Clubs meeting at Jones Family Farm, Shelton (October 29) (15 participants).

MS. ROSE HISKES participated in Connecticut Invasive Plant Working Group (CIPWG) Symposium planning committee meetings via Zoom (16 attendees) (October 6 and 20). Gave a talk on ‘Invasive Plants’ to the Northville Residents Association in New Milford (28 attendees) (October 22).

PUBLICATIONS

1. Liao, Y.-C.-Z., Yu, W., Si, Y.-Z., Geng, J.-X., Li, D.-W., and Zhu, L.-H.. (2022). Leaf spot of *Ligustrum japonicum* caused by *Diaporthe eres* newly reported in China. *Crop Protection*, 164. DOI: [10.1016/j.cropro.2022.106139](https://doi.org/10.1016/j.cropro.2022.106139)

Abstract: *Ligustrum japonicum* is widely cultivated as ornamental and hedges in residential areas, parks and roadsides in China. A leaf spot disease has been extensively observed on *L. japonicum* in Nanjing, Jiangsu, China since September 2020. This disease not only affects the plant's growth, but also leads to unsightly appearances. A fungal species was isolated from symptomatic leaves. Its colony on PDA was white with aerial mycelia; the reverse of the colony was white. Both α - and β -conidia were observed. Morphological features of this fungus matched those of *Diaporthe* spp. For accurate identification, partial sequences of the internal transcribed spacer region (ITS), elongation factor 1-alpha (*EF*), calmodulin (*CAL*), beta-tubulin (*TUB*), and histone H3 (*HIS*) genes were amplified and sequenced. Phylogenetic trees verified that this species is *Diaporthe eres*. Pathogenicity tests were conducted by inoculating healthy leaves with mycelium plugs and Koch's postulates were confirmed by pathogen re-isolation and identification. This is the first report that *D. eres* causes *L. japonicum* leaf spot in China.

2. He, J., Li, D.-W., Zhu, Y.-N., Si, Y.-Z., Bian, J.-Y., Cui, W.-L., and Huang, L. (2022). Diversity and pathogenicity of *Colletotrichum* species causing anthracnose on *Cunninghamia lanceolata*. *Plant Pathology*, 71(8), 1757-1773. DOI: [10.1111/ppa.13611](https://doi.org/10.1111/ppa.13611)

Abstract: Chinese fir (*Cunninghamia lanceolata*) is a fast-growing tree species with high economic value. Anthracnose caused by *Colletotrichum* species poses a serious threat to Chinese fir production. To investigate the *Colletotrichum* species associated with anthracnose on Chinese fir, a survey was conducted from 2016 to 2020 in China. A total of 52 *Colletotrichum* isolates was collected from six different provinces: Fujian, Guangdong, Jiangsu, Jiangxi, Shandong and Zhejiang. These isolates were identified using morphological and multilocus phylogenetic analyses with the concatenated sequences of the rDNA internal transcribed spacer (ITS), glyceraldehyde-3-phosphate dehydrogenase (GAPDH), chitin synthase (CHS-1), actin (ACT), β -tubulin (TUB2), calmodulin (CAL) and the intergenic region between *Apn2* and *Mat1-2-1* (*ApMat*). *Colletotrichum cangyuanense*, *C. fructicola*, *C. gloeosporioides*, *C. karstii* and *C. siamense* were revealed to be associated with anthracnose on Chinese fir. Pathogenicity tests showed that there were significant differences in the pathogenicity of these *Colletotrichum* species on the host plants. To our knowledge, this study reports the pathogen diversity of anthracnose on Chinese fir for the first time.

3. Yuan, Y., Wu, Y.-D., Wang, Y.-R., Zhou, M., Qiu, J.-Z., Li, D.-W., Vlasák, J., Liu, H.-G. and Dai, Y.-C. (2022). Two new forest pathogens in *Phaeolus* (Polyporales, Basidiomycota) on Chinese coniferous trees were confirmed by molecular phylogeny. *Front. Microbiol.* 13. DOI: [10.3389/fmicb.2022.942603](https://doi.org/10.3389/fmicb.2022.942603)

Abstract: *Phaeolus schweinitzii* (Fr.) Pat. was originally described in Europe and is considered a common forest pathogen on conifers in the Northern Hemisphere. Our molecular phylogeny based on samples from China, Europe, and North America confirms that *P. schweinitzii* is a species complex, including six taxa. *P. schweinitzii* sensu stricto has a distribution in Eurasia; the samples from Northeast and Southwest China are distantly related to *P. schweinitzii* sensu stricto, and two new species are described after morphological, phylogenetic, and geographical analyses. The species growing on *Larix*, *Picea*, and *Pinus* in Northeast China is described as *Phaeolus asiae-orientalis*. Another species mostly occurring on *Pinus yunnanensis* in Southwest China is *Phaeolus yunnanensis*. In addition, three taxa distributed in North America differ from *P. schweinitzii* sensu stricto. *Phaeolus tabulaeformis* (Berk.) Pat. is in Southeast North America, “*P. schweinitzii*-1” in Northeast North America, and “*P. schweinitzii*-2” in western North America.

Luo, X., **Wang, Z.**, Wang, C., Yue, L., **Elmer, W.**, **White, J. C.**, Cao, X., and Xing, B. Nanomaterial size and surface modification mediate disease resistance activation in cucumber (*Cucumis sativus*). *ACS Nano*.

Chen, F., Du, H., Liu, Y., **White, J. C.**, **Wang, Z.**, and Xing, B. Multi-RNA-guided CRISPR-Cas9 delivery by nitrogen doped-carbon dots for reducing antibiotic resistance in the environment. *Nature Communications*.

Zhao, B., Zhang, S., Zhang, X., Zhao, Q., **White, J. C.**, and Xing, B. Quantitatively differentiating foliar adhesion and absorption of different lead particles on *Solanum melongena* L. *ACS Nano*.

Vogels, C. B. F., **Brackney, D. E.**, Dupuis II, A. P., Robich, R. M., Fauver, J. R., Brito, A. F., **Williams, S. C.**, **Anderson, J. F.**, Lubelczyk, C. B., Lange, R. E., Prusinski, M. A., Kramer, L. D., Gangloff-Kaufmann, J. L., Goodman, L. B., Baele, G., Smith, R. P., **Armstrong, P. M.**, Ciota, A. T., Dellicour, S., and Grubaugh, N. D. Phylogeographic reconstruction of the emergence and spread of Powassan virus in the northeastern United States. *BioRxiv*.

Sakhno, Y., Esposti, L. D., Adamiano, A., Borgatta, J., **Cahill, M.**, **Vaidya, S.**, **White, J. C.**, Iafisco, M., and Jaisi, D. Development of citrate-stabilized amorphous calcium phosphate nanoparticles doped with micronutrients as an efficient and sustainable fertilizer. *ACS Sustainable Chemistry and Engineering*.

Bonser, C. A. R., **Tamez, C.**, **White, J. C.**, Astete, C. E., Sabliov, C. M., and Davis, J. A. Field testing zein as a precise nanoscale delivery system for methoxyfenozide. *Insect Science*.

Adeel, M., Ahmad, M. A., **White, J. C.**, Kah, M., and Fraceto, L. Nano-enabled approaches for sustainable development of food and agricultural systems. *NanoImpact*.

Wang, D. and **White, J. C.** Determining the cost and benefit of nano-enabled agrochemicals. *Nature Food*.

Borgatta, J., Shen, Y., **Tamez, C.**, Green, C., Orbeck, J., **Cahill, M.**, Protter, C., **Deng, C.**, **Wang, Y.**, **Elmer, W.**, **White, J. C.**, and Hamers, R. L. Influence of CuO nanoparticle aspect ratio and surface termination on disease suppression in tomato (*Solanum lycopersicum*). *Journal of Agricultural and Food Chemistry*.

Vogels, C. B. F., **Brackney, D. E.**, Dupuis, A. P. II., Robich, R. M., Fauver, J. R., Brito, A. F., **Williams, S. C.**, **Anderson, J. F.**, Lubelczyk, C. B., Lange, R. E., Prusinski, M., A., Kramer, L. D., Gangloff-Kaufmann, J. L., Goodman, L. B., Baele, G., Smith, R. P., **Armstrong, P. M.**, Ciota, A. T., Dellicour, S., and Grubaugh, N. D. Phylogeographic reconstruction of the emergence and spread of Powassan virus in the northeastern United States. *Proceeding of the National Academy of Sciences*.

Kummel, M. L., **Shabtai, I. A.**, Nir, S., and Mishael, Y. G. DOM removal from surface water by activated carbon vs. a nanocomposite: an experimental and modeling approach to optimize treatment. *Water Research*.



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